B 63/5

Boise Project

Idaho: Elmore, Ada, Boise, Canyon, Gem, and Payette Counties
Oregon: Malheur County

Pacific Northwest Region
Bureau of Reclamation

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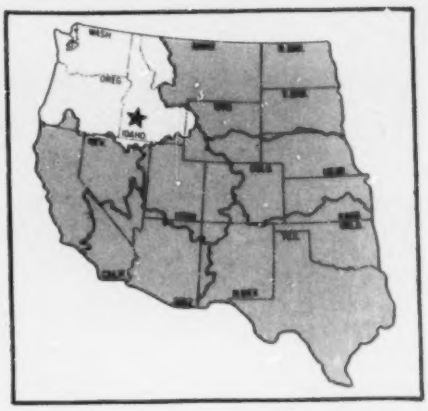

The Boise Project furnishes irrigation water to about 225,000 acres of project lands and 167,000 acres under special and Warren Act contracts. The irrigable lands are in southwestern Idaho and eastern Oregon.

Principal facilities include six storage dams which form reservoirs with a total active capacity of 1,693,500 acre-feet, two diversion dams, three powerplants with a combined capacity of 36,500 kilowatts, 346 miles of canals, seven pumping plants, 929 miles of laterals, and 342 miles of drains.

To facilitate organization of the administrative and operating procedures, the irrigable project lands are divided into the Arrowrock and Payette Divisions. Some of the features serve only one division; other features serve both divisions as well as other nearby projects.

PLAN

The Arrowrock Division consists of 164,641 irrigable acres, and an additional 112,400 acres are furnished supplemental water. Water for the division is stored in Anderson Ranch Reservoir on the South Fork of the Boise River, Arrowrock Reservoir on the Boise River, and in Lake Lowell, an offstream lake in a large depression. Anderson Ranch Dam is 42 miles upstream from Arrowrock Dam. Boise River Diversion Dam, 16 miles downstream from Arrowrock and 7 miles southeast of the city of Boise, diverts water into the New York Canal, which delivers the water to Arrowrock Division lands.

During the nonirrigation season, the New York Canal carries a portion of the water released from Anderson Ranch and Arrowrock Dams to fill Lake Lowell for use in the division during the irrigation season. Water from Lake Lowell is carried to project lands by the Deer Flat Low Line, Deer Flat North, Deer Flat Nampa, and Deer Flat Caldwell Canals. There are 5 regular irrigation districts within the Arrowrock Division receiving water from the project, and 11 districts receiving water from the division under the Warren Act. Power is produced at Boise River Diversion Dam and Anderson Ranch Dam.

Lucky Peak Dam, built by the Corps of Engineers, is about 1 mile upstream from Boise River Diversion Dam and backs water up to Arrowrock Dam. Lucky Peak Reservoir has an active capacity of 278,200 acre-feet and was built for flood control purposes. By agreement among the Corps of Engineers, Boise Project Board of Control, and the Bureau of Reclamation, the Anderson Ranch, Arrowrock, and Lucky Peak storage reservoirs on the Boise River are operated jointly for the benefit of irrigation, power, and flood control. These three reservoirs have a total active capacity of 987,800 acre-feet.

Lands in the Payette Division receive water from the Payette River and surplus drainage from the Arrowrock Division. Storage features are Deadwood Reservoir on Deadwood River, a tributary of the South Fork of the Payette River, and Cascade Reservoir on the North Fork of the Payette. Water is diverted into the Black Canyon Canal (south side) and then into the distribution system. In the project area, the main canal separates into two supply lines which serve 27,186 acres by gravity flow. About 20 miles below Black Canyon Dam, a pumping plant lifts water from the main canal into a lateral system

Anderson Ranch Dam and Powerplant

Region Revision 5/82
(From Project Data Book)

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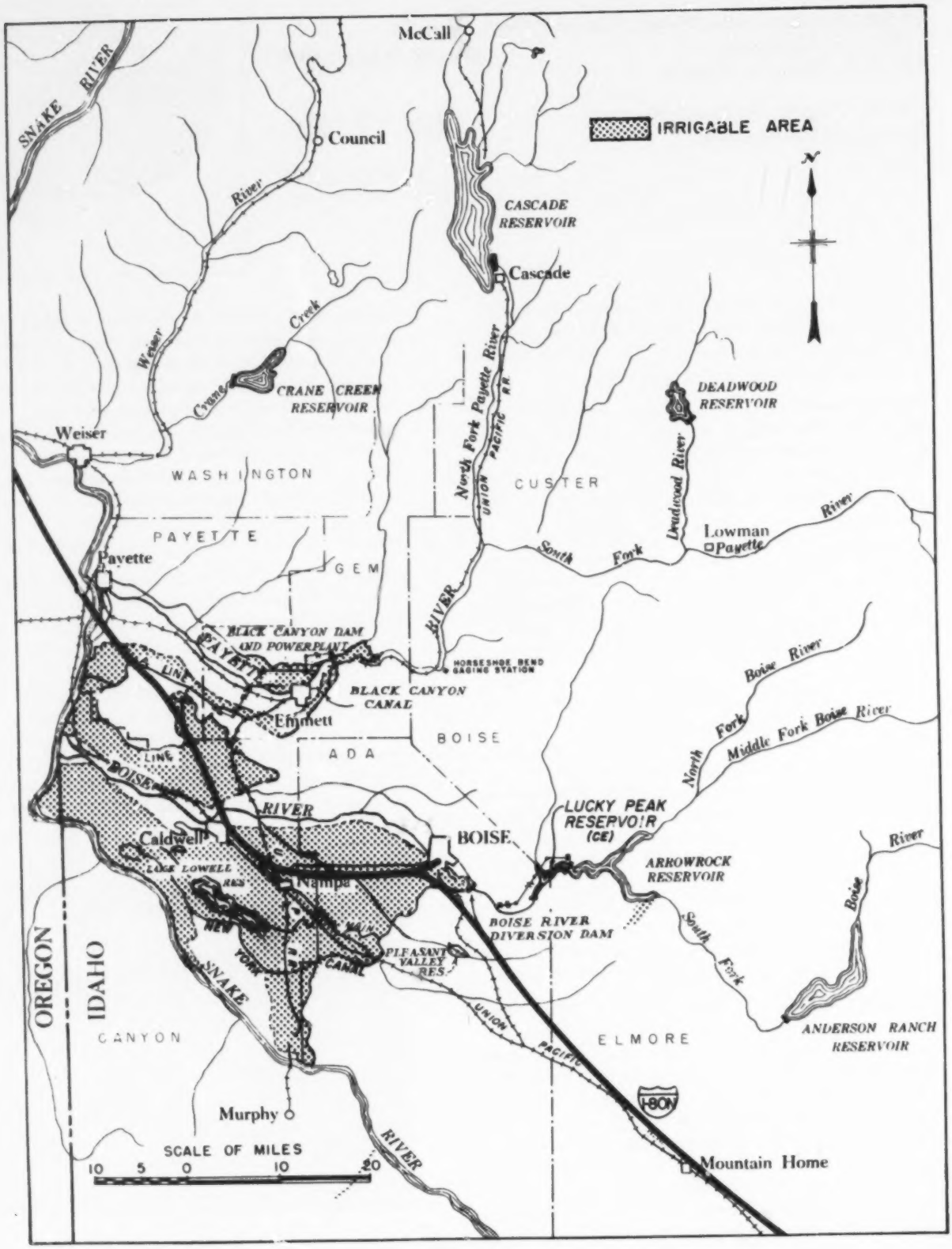
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UNION PACIFIC R.R.
DEADWOOD RESERVOIR
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Weiser
WASHINGTON
CUSTER
PAYETTE
GEM
Payette
South Fork
Lowman
Payette River
BLACK CANYON DAM AND POWERPLANT
PAYETTE
LINE
HORSESHOE BEND GAGING STATION
BLACK CANYON CANAL
Emmett
BOISE
ADA
Boise River
North Fork
Middle Fork Boise River
BOISE
LINE
RIVER
LUCKY PEAK RESERVOIR (CE)
Caldwell
BOISE
LAKE LOWELL RES.
Nampa
ARROWROCK RESERVOIR
Boise River
NEW YORK CANAL
MAIN
BOISE RIVER DIVERSION DAM
PLEASANT VALLEY RES.
South Fork
SNAKE
OREGON
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CANYON
UNION PACIFIC
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ANDERSON RANCH RESERVOIR
I-80N
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10 5 0 10 20
RIVER
Mountain Home

serving 26,014 acres. The 6,881-acre Notus Unit of the Payette Division obtains water from two Arrowrock Division drains south of the Boise River near Caldwell. The three acreages are in the Black Canyon Irrigation District. The 25,000-acre Emmett Irrigation District, outside the project area, receives water under a Warren Act contract, partially from the Black Canyon Canal but primarily from the Emmett Canal (north side). Both canals divert water from the Payette River at Black Canyon Dam. Power is produced at Black Canyon Dam.

Anderson Ranch Dam and Powerplant

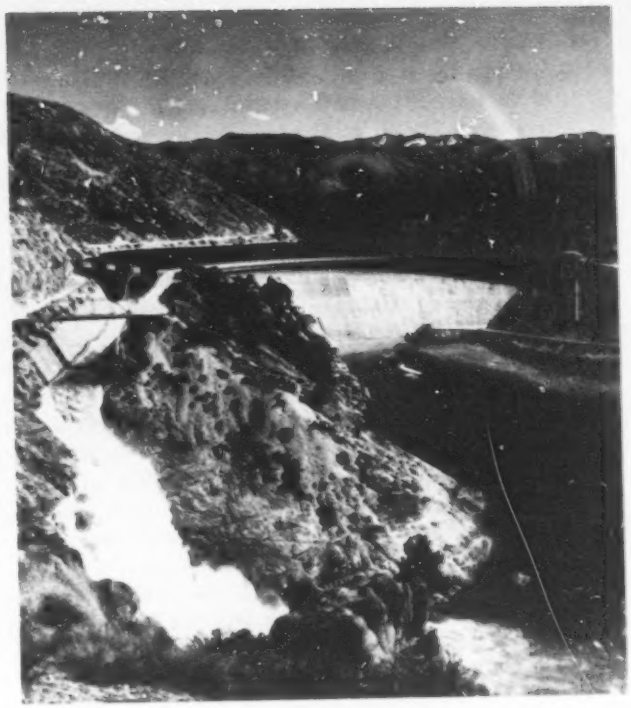
Anderson Ranch Dam and Powerplant is a multiple-purpose structure that provides benefits in irrigation, power, and flood and silt control. Situated on the South Fork of the Boise River 20 miles northeast of Mountain Home, the dam is 456 feet high, was the world's highest earthfill dam at the time of its construction, and has a total storage capacity of 493,200 acre-feet. The powerplant has an existing rated capacity of 27,000 kilowatts with two units installed. By rewinding, the rated capacity can be increased to 20,000 kilowatts each for a total of 40,000 kilowatts. These modifications are scheduled for fiscal year 1981, or as soon as funding can be arranged.

Arrowrock Dam

Arrowrock Dam, on the Boise River 42 miles downstream from Anderson Ranch Dam and 22 miles upstream from Boise, is a concrete thick-arch structure 350 feet high. The reservoir has a storage capacity of 286,600 acre-feet. When constructed in 1915, the dam was recorded as being the highest in the world. The structure was repaired and raised 5 feet during 1935-37, increasing its storage by 9,000 acre-feet. The original construction involved the use of a rather high proportion of sand-cement, and by 1935 the concrete on the downstream face of the structure showed deterioration due to climatic conditions. Repairs included refacing the downstream face and spillway channel.

Boise River Diversion Dam and Powerplant

The Boise River Diversion Dam, on the Boise River about 7 miles southeast of Boise, Idaho, is a rubble-concrete, weir-type structure with a hydraulic height of 39 feet, and was originally built to supply power for the construction of Arrowrock Dam. The dam diverts water into the New York Canal which serves distributing laterals and feeds Lake Lowell. A small canal known as the Penitentiary Canal, also heading from the diversion dam, distributes water on the north side of the Boise River to a small area of land east of Boise. The powerplant consists of three 500-kilowatt units that began operation in 1912.



Arrowrock Dam

Lake Lowell

Lake Lowell, originally known as Deer Flat Reservoir, is formed by three earthfill dams that are 16, 46, and 74 feet high, enclosing a natural depression. The lake lies offstream within the project area near Nampa, stores 190,000 acre-feet, and is filled during the nonirrigation season from the Boise River Diversion Dam through the New York Canal.

Arrowrock Division Canal System

The New York Canal is about 40 miles long and has a diversion capacity of 2,800 cubic feet per second. It consists of the enlarged old New York Canal, a section of new canal, and a part of the channel of Indian Creek.

The Deer Flat High Canal is 22 miles long and has a diversion capacity of 130 cubic feet per second. The Deer Flat Low Canal has a length of about 37 miles and diversion capacity of 1,200 cubic feet per second.

Deadwood Dam

Deadwood Dam, 25 miles southeast of Cascade, Idaho, on the Deadwood River, is a concrete-arch structure. It has a structural height of 165 feet and stores 162,000 acre-feet of water that provides a regulated flow for the powerplant at Black Canyon Dam and for irrigation in the Payette Division and Emmett Irrigation District.

Cascade Dam

Cascade Dam, near Cascade, Idaho, on the North Fork of the Payette River, is a zoned earthfill structure 785 feet across the crest. The total storage capacity is 703,000 acre-feet.

Black Canyon Dam and Powerplant

Black Canyon Dam, on the Payette River near Emmett, Idaho, is a concrete gravity type dam with an ogee overflow spillway. The dam has a structural height of 183 feet and serves to divert water to the Payette Division through the Black Canyon Canal. Two direct-connected turbine-driven pumps, located in the powerhouse, serve the Emmett Irrigation District Canal on the north side of the river. The powerplant has a capacity of 8,000 kilowatts. The plant supplies power to the Boise Project, and, by wheeling over facilities of the Idaho Power Company, to Owyhee and Minidoka Projects. Surplus power is delivered to the Bonneville Power Administration. A short transmission line connects the Black Canyon Powerplant with the lines of the Idaho Power Company while another line supplies the "C" Line Canal Pumping Plant.

Pumping Plants

The pumping plants are: (1) Black Canyon at the Black Canyon Dam; (2) "C" Line Canal at station 1064 on the Black Canyon Canal; and (3) Willow Creek at station 1111 on "C" Line Canal East, about 4 miles northeast of Middleton, Idaho. There are also four small relift pumping plants.

The Black Canyon Pumping Plant contairs two pumps directly connected to turbines; the "C" Line Canal plant has five pumps; and Willow Creek has two motor-driven pumps lifting water from the "C" Line Canal East.

Payette Division Canal System

The Black Canyon Canal is 29 miles long and extends from the Black Canyon Dam south and west along the Payette River. The canal has a diversion capacity of 1,300 cubic feet per second.

The "C" Line Canal East, with diversion capacity of 469 cubic feet per second, begins at "C" Line Canal Pumping Plant on the Black Canyon Canal and is 21 miles long. The "C" Line Canal West branches from the "C" Line Canal East, extends 24 miles, and has a diversion capacity of 60 cubic feet per second.

The "A" Line and "D" Line Canals begin at the terminus of the Black Canyon Canal. The "A" Line Canal is 33 miles long and has a diversion capacity of 226 cubic feet per second; the "D" Line Canal, 39 miles long, has a diversion capacity of 254 cubic feet per second.

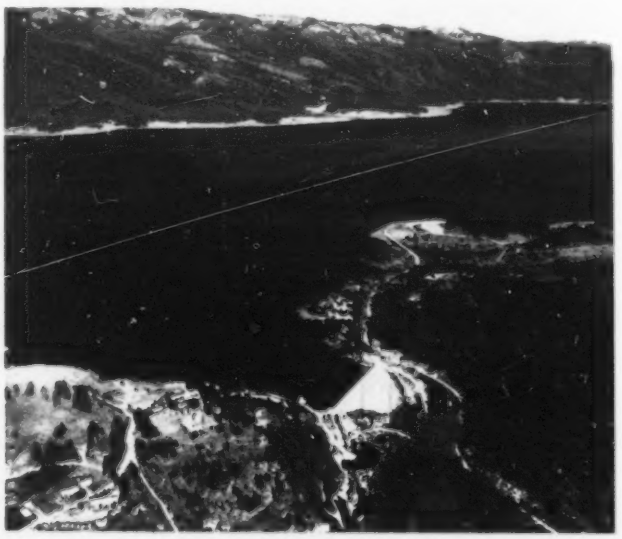
DEVELOPMENT

Early History

The first right to divert water from the Boise River for irrigation purposes was granted in 1864. The water irrigated the townsite of Boise and supplied Fort Boise. Agricultural activity in the Boise and Payette Valleys started in the early 1880's when settlers began filing on desert lands under private irrigation enterprises. By 1900, about 148,000 acres had been placed under irrigation.

Since its first authorization in 1905, the Boise Project has expanded in accordance with an orderly program of development that has included the construction of five

Black Canyon Dam

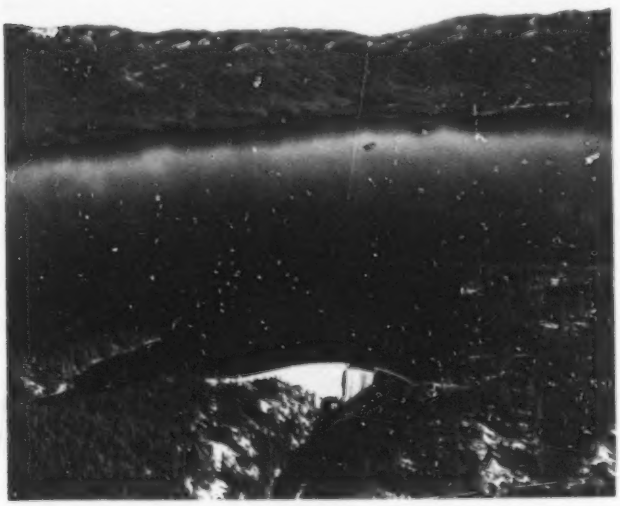


Cascade Dam and Reservoir

major reservoirs, two principal diversion dams, three sizable pumping plants, three powerplants, and related facilities. In addition, several structures that were constructed in the early stages of development have been rehabilitated or repaired to improve operations and extend the life of the facilities.

Investigations

Diversion from the river with simple ditches served adequately to irrigate lands in the vicinity of the river, but development of additional lands at higher elevations proved too difficult and costly to be undertaken by private capital. In response to petitions by local irrigators, the Boise Project was initiated by the Reclamation Service shortly after the passage of the first Reclamation Act in 1902. Subsequent investigations have resulted in completion of many structures as need arose.



Deadwood Dam and Reservoir

Studies are underway for inclusion of a third generating unit in the Anderson Ranch Dam Powerplant. The present proposal is considering a 30,000-kilowatt unit. Report of feasibility is targeted for 1980. Congressional authorization will be necessary before construction is implemented.

Authorization

Authorization for construction of the original Boise Project (now the Arrowrock Division) was made on March 27, 1905; the Arrowrock Dam on January 6, 1911; and Black Canyon Dam on June 26, 1922, all by the Secretary of the Interior under provisions of the Reclamation Act of June 17, 1902 (32 Stat. 388). Deadwood Dam and Reservoir were approved on October 19, 1928, and Payette Division on December 19, 1935, by the President under section 4 of the act of June 25, 1910 (36 Stat. 836). Anderson Ranch Dam and Reservoir were found feasible and authorized on August 12, 1940, by the Secretary of the Interior under the Reclamation Project Act of 1939 (53 Stat. 1187).

Construction

The 277,000-acre Arrowrock Division serves that portion of the Boise Project lands situated between the Boise and Snake Rivers. Lake Lowell was completed by June 1911; Arrowrock Dam and Reservoir commenced storing water in 1915; Boise River Diversion Dam was completed by October 10, 1908, and Anderson Ranch Dam was completed in 1950. The powerplant at Boise River Diversion Dam, built originally to supply power for construction of Arrowrock Dam, was placed in operation in 1912. As the reservoirs were built, a system of canals, laterals, and drains was constructed.

The 114,000-acre Payette Division includes lands between the Payette and Boise Rivers and lands north of the Payette River in the Emmett Irrigation District that are irrigated from the Payette River and from drains operated within the Arrowrock Division. Black Canyon Dam on the Payette River, which heads the gravity distribution system, was completed in 1924; Deadwood Dam and Reservoir on the Deadwood River in 1931; and Cascade Dam and Reservoir on the North Fork of the Payette River in 1948. The gravity distribution system was constructed during 1936-40. Supplementing this system, a combination pump-gravity canal, designated the "C" Line, was completed in 1948.

Operating Agencies

The operating organization for the Arrowrock Division of the project is the Boise Project Board of Control, which was formed in 1926 by contracts between the Bureau of Reclamation and the five irrigation districts representing the water users that make up the project.

The Bureau of Reclamation operated the project until April 1, 1926, when the operation was turned over to the newly organized irrigation districts under the act of December 5, 1924, known as the Fact Finders' Law. However, Reclamation retained the operation and maintenance of certain parts of the system, referred to as the "reserved works," which include Arrowrock and Anderson Ranch Reservoirs, the Boise River Diversion Dam and Powerplant, and headworks of the main canal.

In the Payette Division, Reclamation operates and maintains Deadwood and Cascade Reservoirs, and Black Canyon Dam and Powerplant. All irrigation carriage and distribution systems are operated by the water users.

Boise River Diversion Dam

BENEFITS

Irrigation

The project area, comprising about 391,000 acres, was once desert land except for small sections of river bottom. Principally through facilities provided by the Bureau of Reclamation, irrigation farmers have turned the desert into a productive agricultural area with thriving cities and towns.

A major portion of the Nation's requirement for sweet corn seed is grown on the Boise Project. The project also produces large quantities of grain, alfalfa hay, pasture, sugar beets, corn, potatoes, onions, apples, prunes, and alfalfa seed. The hay and forage crops support a large number of dairy and beef cattle.

Hydroelectric Power

On the Boise Project, as a multiple-purpose feature, hydroelectric power is produced at three powerplants: A 27,000-kilowatt installation at Anderson Ranch Dam; a 1,500-kilowatt plant at the Boise River Diversion Dam; and an 8,000-kilowatt plant at Black Canyon Dam.

The Black Canyon and Boise River Diversion Dam Powerplants provide energy for pumping to the Payette Division lands and the Emmett Irrigation District. Anderson Ranch power serves pumping loads in the Minidoka and Owyhee Projects. Surplus power from these plants is turned over to the Bonneville Power Administration for marketing.

Flood Control

A formal flood control operating agreement for the Boise River system has been signed by the Corps of Engineers and the Bureau of Reclamation. Sufficient space is maintained in Anderson Ranch, Arrowrock, and Lucky Peak Reservoirs on a forecast basis to prevent the riverflow through Boise from exceeding 6,500 cubic feet per second.

Cascade and Deadwood Reservoirs are operated on an informal forecast basis to control the flow of the Payette River through Horseshoe Bend so as not to exceed 12,000 cubic feet per second.

Recreation and Fish and Wildlife

The six project reservoirs are located in the most populous portion of Idaho, and are used extensively by recreationists. The reservoirs provide a variety of settings. Anderson Ranch, Arrowrock, and Deadwood Reservoirs are located in the mountains. Cascade Reservoir is in a broad, mountain-encircled valley. Black Canyon Reservoir fills a narrow canyon at the foot of massive Squaw Butte, and Lake Lowell is located in an area of agricultural development. A total of 21,635 acres of land and 48,230 acres of water surface are included in these reservoir areas.

Cascade Reservoir, the largest of the six with 28,300 acres of water surface, offers excellent warm- and cold-water fishing as well as ice fishing, and is used by numerous waterfowl in the spring and fall. Anderson Ranch Reservoir offers excellent fishing for trout and smallmouth bass, and provides exciting fishing for kokanee salmon during their spawning runs. About one-third of the land has been established as a game management area. Arrowrock Reservoir is heavily drafted to supply irrigation water but is still used extensively by ducks and is stocked annually with trout. Deadwood Reservoir is nestled among forested mountain slopes and offers good trout fishing. The Lake Lowell area contains the Deer Flat National Wildlife Refuge which is used by millions of waterfowl annually. There is excellent warm-water fishing as well as both upland game bird and waterfowl hunting. The lake also has heavy boating use. The long, narrow Black Canyon Reservoir has little fluctuation in water level and is used for boating and water skiing. About 1,100 acres of the Montour Valley above the reservoir have been acquired and are managed as a recreation and wildlife area. Camping facilities have been constructed at all areas except Black Canyon Reservoir and Lake Lowell.

PROJECT DATA

Land Areas (1980)

Irrigable area:		
Full irrigation service	224,722	acres
Supplemental irrigation service	166,650	acres
Total	391,372	acres
Number of irrigated farms	8,462	

Area Irrigated and Crop Value

Year	Area irrigated, acres	Crop value, dollars
1968	344,999	48,946,476
1969	343,411	52,671,563
1970	342,528	52,885,242
1971	340,333	58,443,534
1972	336,851	65,162,650
1973	340,613	87,467,957
1974	339,738	120,241,514
1975	337,944	109,418,576
1976	338,087	91,181,716
1977	327,815	104,624,655
1978	333,368	116,123,543
1979	333,148	138,739,146
1980	330,341	167,026,536

Gross Power Generation

Fiscal year	Anderson Ranch Powerplant, kWh	Black Canyon Powerplant, kWh	Boise River Diversion Powerplant, kWh	Total, kWh
1968	136,025,000	71,820,700	2,029,100	209,874,800
1969	153,351,000	73,707,700	2,510,900	229,569,600
1970	161,066,000	76,552,800	287,900	237,906,700
1971	165,775,000	71,984,500	0	237,759,500
1972	188,054,000	73,866,200	0	261,920,200
1973	137,984,000	72,497,200	2,093,830	212,575,030
1974	188,331,000	73,696,900	4,923,080	266,950,980
1975	161,261,000	81,153,900	3,902,460	246,317,360
1976	220,567,000	90,357,300	7,694,500	[1]318,618,800
1977	115,461,000	44,038,600	6,473,210	165,972,810
1978	112,521,000	74,671,600	2,879,850	190,072,450
1979	131,731,000	79,358,400	3,565,840	214,655,240
1980	131,538,000	50,330,700	6,880,330	188,749,030

[1]15-month period. Transitional quarter July-September 1976 included. Fiscal year changed from July-June to October-September.

Facilities in Operation

Storage dams	6	
Diversion dams	2	
Canals	346	mi
Laterals	929	mi
Pumping plants	7	
Drains	342	mi
Powerplants	3	
Transmission lines	31.8	mi
Substations	7	

Climatic Conditions (1966-80)

Average annual precipitation	11.5	in
Temperature:		
Maximum	108	°F
Minimum	—23	°F
Mean	51	°F
Growing season	182	days
Elevation of irrigable area	2500.0	ft

Settlement

Number of persons served with project water (1980):		
Farm irrigation service	26,870	
Other water service[2]	117,701	
Total	144,571	

[2]Urban and suburban, residential, commercial, and industrial lands.

ENGINEERING DATA

Water Supply

Boise River

Drainage area above Boise River Diversion Dam	2,680	mi²
Annual discharge[3] (1966-80):		
Maximum (1971)	3,393,900	acre-ft
Minimum (1977)	658,200	acre-ft
Average	2,054,600	acre-ft

Payette River

Drainage area above Horseshoe Bend, Idaho	2,230	mi²
Annual discharge[3] (1966-80):		
Maximum (1974)	4,068,400	acre-ft
Minimum (1977)	730,400	acre-ft
Average	2,449,100	acre-ft

[3]Unregulated discharge

Storage Facilities

Anderson Ranch Dam

Type: Zoned earthfill		
Location: South Fork Boise River, 20 mi northeast of Mountain Home, Idaho.		
Construction period: 1941-50		
Date of closure (first storage): Dec. 15, 1945.		
Reservoir, Anderson Ranch:		
Annual inflow (1966-80):		
Maximum (1971)	1,224,500	acre-ft
Minimum (1977)	224,900	acre-ft
Average	732,800	acre-ft
Total capacity to El. 4196	493,200	acre-ft
Active capacity	423,000	acre-ft
Surface area	4,740	acres
Dimensions:		
Structural height	456	ft
Hydraulic height	330	ft
Top width	40	ft
Maximum base width	3,000	ft
Crest length	1,350	ft
Crest elevation	4206.0	ft
Volume	9,653,000	yd³
Spillway: Concrete-lined chute at left abutment controlled by two 25- by 22-ft radial gates.		
Outlet works:		
Service: Tunnel and steel penstock and outlet pipes through left abutment controlled by five 72-in hollow-jet valves.		
Power: Three 90-in steel penstocks from outlet pipe.		
Capacity at El. 4198	10,000	ft³/s
Foundation: Granite overlaid with clay, gravel, sand, and silt to a depth of 120 ft in the floor of the canyon.		
Special treatment: Grout curtain beneath, and blanket grouting between cutoff walls.		

Arrowrock Dam

Type: Concrete thick arch		
Location: On Boise River, 13 mi east of Boise, Idaho.		
Construction period: 1911-15		
Dam and spillway crest raised 5 ft in 1937.		
Date of closure (first storage): Oct. 22, 1914.		
Reservoir, Arrowrock:		
Annual inflow[4] (1966-80):		
Maximum (1971)	2,965,700	acre-ft
Minimum (1977)	634,800	acre-ft
Average	1,781,400	acre-ft
Total and active capacity to El. 3216	286,600	acre-ft
Surface area	3,100	acres
Dimensions:		
Structural height	350	ft
Hydraulic height	257	ft
Top width	15.5	ft
Maximum base width	223	ft
Crest length	1,150	ft
Crest elevation	3216.0	ft
Volume	636,000	yd³
Spillway: Side channel spillway at right abutment controlled by six 62- by 6-ft drum gates.		
Elevation, top of gates	3216.0	ft
Crest elevation	3210.0	ft
Capacity at El. 3219.75	40,000	ft³/s
Outlet works: Twenty conduits through dam controlled by 58-in balanced valves for service; and five conduits through dam controlled by 5-ft-square slide gates for sluicing.		
Capacity at El. 3210	28,600	ft³/s
Foundation: Hard, sound but seamy, broad zone of granite porphyry, capped in left abutment with 50-ft basaltic lava flow.		
Special treatment: Grout curtain beneath upstream cutoff trench; lava cap removed.		
Mass concrete: Natural aggregate from pit 13 mi downstream from dam, with boulders up to 20 percent of volume added when available. Standard portland cement used with 45 percent pulverized granite for interior and 34 percent for exterior.		
Volume	578,053	yd³
Maximum size aggregate	4.5	in
Average net water-cement ratio by weight	0.65	
Cement content:		
Interior	0.96	bbl/yd³
Exterior	1.05	bbl/yd³

[4]Unregulated inflow

Deer Flat Upper and Lower Dam.[5]

Type: Zoned earthfill		
Location: Offstream, 22 mi southwest of Boise, Idaho.		
Construction period: 1906-08. Upper Dam modified in 1909 and 1913; both dams modified in 1911 and 1938.		
Date of closure (first storage): Spring, 1909.		
Reservoir, Lake Lowell:		
Total capacity to El. 2530.5	190,000	acre-ft
Active capacity	169,000	acre-ft
Surface area	9,840	acres
Dimensions:		
Structural height:		
Upper	74	ft
Lower	46	ft
Crest length:		
Upper	4,164	ft
Lower	7,270	ft
Crest elevation:		
Upper	2538.0	ft
Lower	2538.0	ft
Volume:		
Upper	1,245,000	yd³
Lower	1,240,000	yd³
Outlet works: Five concrete conduits through base of Upper Dam and three through base of Lower Dam, controlled by a 5- by 6-ft slidegate at each dam.		
Capacity at El. 2530.5	400	ft³/s

[5]A 16-ft-high embankment (Deer Flat Middle) closes the reservoir near the Lower Dam.

Deadwood Dam

Type: Concrete thick arch		
Location: On Deadwood River, 25 mi southeast of Cascade, Idaho.		
Construction period: 1929-31		
Date of closure (first storage): Nov. 2, 1930.		
Reservoir, Deadwood:		
Annual inflow (1966-80):		
Maximum (1974)	303,100	acre-ft
Minimum (1977)	52,100	acre-ft
Average	179,400	acre-ft
Total capacity to El. 5334	162,000	acre-ft
Active capacity	161,900	acre-ft
Surface area	3,000	acres
Dimensions:		
Structural height	165	ft
Hydraulic height	137	ft
Top width	9	ft
Maximum base width	62	ft
Crest length	749	ft
Crest elevation	5340.0	ft
Total volume	56,400	yd³
Spillway: Uncontrolled overflow section near center of dam.		
Crest length	100	ft
Crest elevation	5334.0	ft
Capacity at El. 5343.5	11,300	ft³/s
Outlet works: Two pipes through base of dam, controlled by two 54-in needle valves at downstream end.		
Capacity at El. 5334	1,980	ft³/s
Foundation: Hard, sound granite, massive at left abutment and fissured with sheet and block joints at right abutment. Two tightly filled fault-zone seams cross foundation on right side.		
Special treatment: Cement grout curtain beneath upstream cutoff trench; supplementary grouting along downstream toe at right abutment; fault zone excavated and backfilled with concrete.		
Mass concrete: Aggregate, natural from pits near damsite, oversize crushed; standard portland cement, diatomaceous earth added.		
Volume	55,463	yd³
Maximum size aggregate	6	in
Average net water-cement ratio by weight	0.51	
Cement content	1.33	bbl/yd³

Cascade Dam

Type: Zoned earthfill		
Location: On North Fork of Payette River near Cascade, Idaho.		
Construction period: 1946-48		
Date of closure (first storage): 1947		
Reservoir, Cascade:		
Annual inflow[a] (1966-80):		
Maximum (1974)	1,306,900	acre-ft
Minimum (1977)	199,800	acre-ft
Average	743,700	acre-ft
Total capacity to El. 4828	703,000	acre-ft
Active capacity	653,000	acre-ft
Surface area at El. 4828	28,300	acres
Dimensions:		
Structural height	107	ft
Hydraulic height	69	ft
Top width	35	ft
Maximum base width	630	ft
Crest length	785	ft
Crest elevation	4840.0	ft
Total volume	395,000	yd³
Spillway: Concrete-lined chute at right abutment controlled by two 21- by 20-ft radial gates.		
Elevation top of gates	4828.0	ft
Crest elevation	4808.0	ft
Capacity at El. 4828	12,000	ft³/s
Outlet works: Concrete-lined tunnel through right abutment controlled by two 5-ft-square high-pressure slide gates.		
Capacity at El. 4828	2,760	ft³/s

[a]Unregulated inflow

Diversion Facilities

Boise River Diversion Dam

Type: Concrete and masonry weir, with provision for flash boards		
Location: On Boise River, 7 mi southeast of Boise, Idaho.		
Year completed: 1908		
Dimensions:		
Structural height	68	ft
Hydraulic height	39	ft
Crest length	500	ft
Crest elevation	2812.84	ft
Volume	26,100	yd³
Spillway: Ogee overflow		
Capacity	40,000	ft³/s
Headworks: New York Canal heading; eight 5- by 6-ft motor-operated slide gates.		
Diversion capacity	2,815	ft³/s

Black Canyon Dam

Type: Concrete gravity, gated ogee spillway		
Location: On Payette River, 5 mi northeast of Emmett, Idaho.		
Year completed: 1924		
Dimensions:		
Structural height	183	ft
Hydraulic height	111	ft
Crest length	1,039	ft
Crest elevation	2500.0	ft
Volume	81,200	yd³
Spillway: Ogee overflow		
Capacity	40,000	ft³/s
Headworks: Black Canyon Canal heading, 30- by 10.42-ft radial gate at south end of dam. Pumping plant at north end of dam.		
Diversion capacity	1,360	ft³/s

Carriage Facilities

New York Canal

Location: From Boise River Diversion Dam generally west to Lake Lowell.		
Construction period: 1906-08 (Enlarged 1909-12)		
Length	40	mi
Diversion capacity	2,800	ft³/s
Typical maximum section in earth:		
Bottom width	70	ft
Side slopes	1.5:1	
Water depth	8	ft
Typical maximum section, concrete lined:		
Bottom width	40	ft
Side slopes	1.5:1	
Water depth	8	ft
Lining thickness	4	in

Mora Canal

Location: From point on New York Canal about 13 mi west of Boise River Diversion Dam, then northwest past Lake Lowell.		
Construction period: 1909-11		
Length	55.9	mi
Diversion capacity	1,300	ft³/s
Typical maximum section in earth:		
Bottom width	55	ft
Side slopes	1.5:1	
Water depth	4.5	ft

Deer Flat High Line Canal

Location: Near northwest end of Lake Lowell.		
Construction period: 1909-10		
Length	22	mi
Diversion capacity	130	ft³/s
Typical maximum section in earth:		
Bottom width	20	ft
Side slopes	1.5:1	
Water depth	3.5	ft

Deer Flat Low Line Canal

Location: From Lake Lowell northwest about 10 mi, then generally southwest along Snake River.		
Construction period: 1907-08 (Enlarged from 800 to 1,000 cubic feet per second in 1915-16)		
Length	36.7	mi
Diversion capacity	1,200	ft³/s
Typical maximum section in earth:		
Bottom width	45	ft
Side slopes	1.5:1	
Water depth	6	ft

GOLDEN GATE CANAL

Location: From point on Deer Flat Low Line Canal about 5 mi from Lake Lowell, then northwest about 10 mi.
Construction period: 1908-09

Length	18.8 mi
Diversion capacity	500 ft³/s
Typical maximum section in earth:	
Bottom width	40 ft
Side slopes	1.5:1
Water depth	3.4 ft

BLACK CANYON CANAL

Location: From Black Canyon Dam south, then generally west along Payette River.
Construction period: 1936-40

Length	29 mi
Diversion capacity	1,300 ft³/s

"A" LINE CANAL

Location: From point on Black Canyon Canal about 15 mi from Black Canyon Dam generally west to vicinity of Snake River.
Construction period: 1938-40

Length	33 mi
Diversion capacity	226 ft³/s
Typical maximum section in earth:	
Bottom width	12 ft
Side slopes	1.5:1
Water depth	5.4 ft

"D" LINE CANAL

Location: From point on Black Canyon Canal about 15 mi from Black Canyon Dam generally west to vicinity of Snake River.
Construction period: 1938-40

Length	39 mi
Diversion capacity	254 ft³/s
Typical maximum section in earth:	
Bottom width	12 ft
Side slopes	1.5:1
Water depth	5.4 ft

"C" LINE CANAL EAST

Location: From "C" Line Canal Pumping Plant on Black Canyon Canal generally southwest about 10 mi to vicinity of Willow Creek Pumping Plant.
Construction period: 1946-48

Length	21 mi
Diversion capacity	469 ft³/s
Typical maximum section in earth:	
Bottom width	16 ft
Side slopes	1.5:1
Water depth	7.5 ft

"C" LINE CANAL WEST

Location: From about Mile 1 on "C" Line Canal East, then generally west.
Construction period: 1946-47

Length	24 mi
Diversion capacity	60 ft³/s
Typical maximum section in earth:	
Bottom width	7 ft
Side slopes	1.5:1
Water depth	3 ft

NOTUS CANAL

Location: Near Caldwell, Idaho.
Construction period: 1919-20

Length	25 mi
Diversion capacity	120 ft³/s
Typical maximum section in earth:	
Bottom width	16 ft
Side slopes	1.5:1
Water depth	3 ft
Typical maximum section, concrete lined:	
Bottom width	12 ft
Side slopes	1.5:1
Water depth	3 ft
Lining thickness	3 and 3.5 in

PUMPING PLANTS

Designation	Number of units	Total capacity, ft³/s	Total dynamic head, ft	Total horsepower
"C" Line Canal	5	600	92	7,250
Black Canyon	2	270	27	1,250
Willow Creek	2	27	39	160
"C" Line Relift Plants No. 7, 8, 10, and 11		8.5	16-24	

Power Facilities

BLACK CANYON POWERPLANT

Location: Black Canyon Dam
Year of initial operation: 1925
Year last generator placed in operation: 1925

Nameplate capacity	8,000 kW
Number and nameplate capacity of generators (2)	4,000 kW
Maximum head	93.5 ft

BOISE RIVER DIVERSION POWERPLANT

Location: Boise River Diversion Dam
Year of initial operation: 1912
Year last generator placed in operation: 1912

Nameplate capacity	1,500 kW
Number and nameplate capacity of generators (3)	500 kW
Maximum head	33.25 ft

ANDERSON RANCH POWERPLANT

Location: Anderson Ranch Dam
Year of initial operation: 1950
Year last generator placed in operation: 1951

Nameplate capacity:		
Existing	27,000	kW
Ultimate	70,000	kW
Number and nameplate capacity of generators:		
Existing (2)	13,500	kW
Ultimate (2)	20,000	kW
(1)	30,000	kW
Maximum head	324	ft

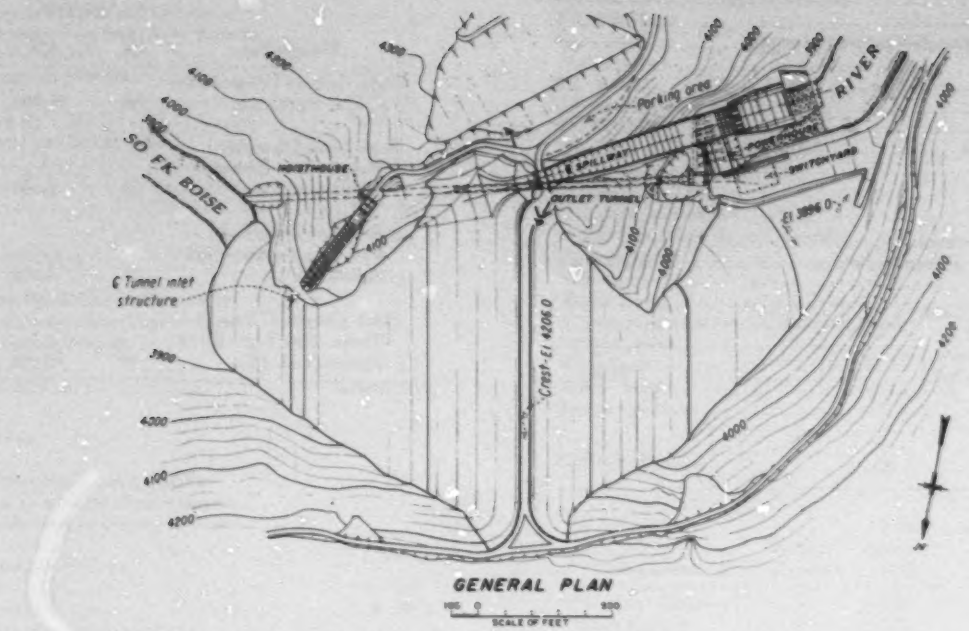
SUBSTATIONS

Number in operation	7	
Total capacity of transformers	53,740	kVA

TRANSMISSION LINES

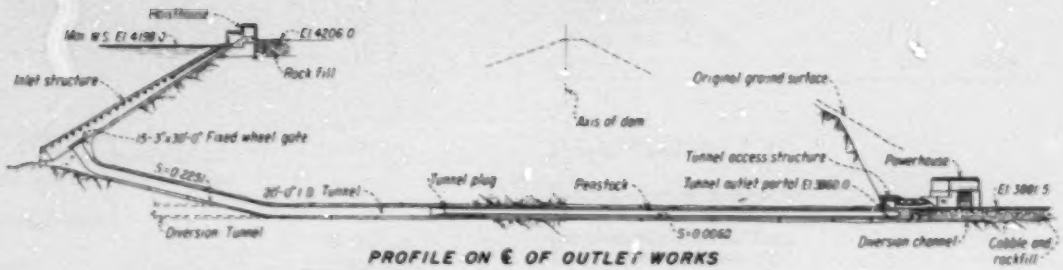
Number of lines	4
Total circuit miles	31.8

Designation	Capacity kV	Capacity kW	Circuit miles	Year placed in service
Black Canyon Powerplant—C Line Substation	69	10,000	17.65	1948
Boise River Diversion Powerplant—Barber Interconnection	23	2,000	0.70	1912
Boise River Diversion Powerplant—Arrowrock Substation	23	1,000	11.75	1954
Black Canyon C Line Trans. Line Tap—Black Canyon I.D. PP	69	10,000	1.75	1968

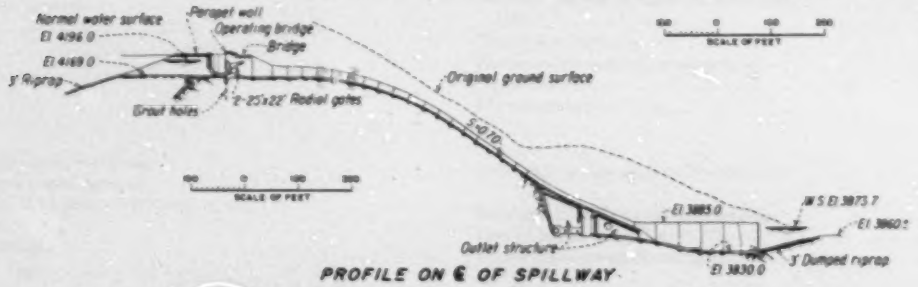


GENERAL PLAN

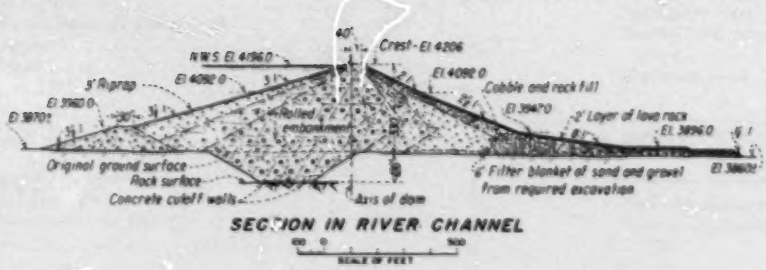
SCALE OF FEET



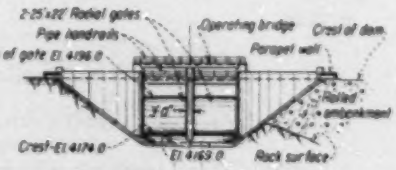
PROFILE ON ℄ OF OUTLET WORKS



PROFILE ON ℄ OF SPILLWAY

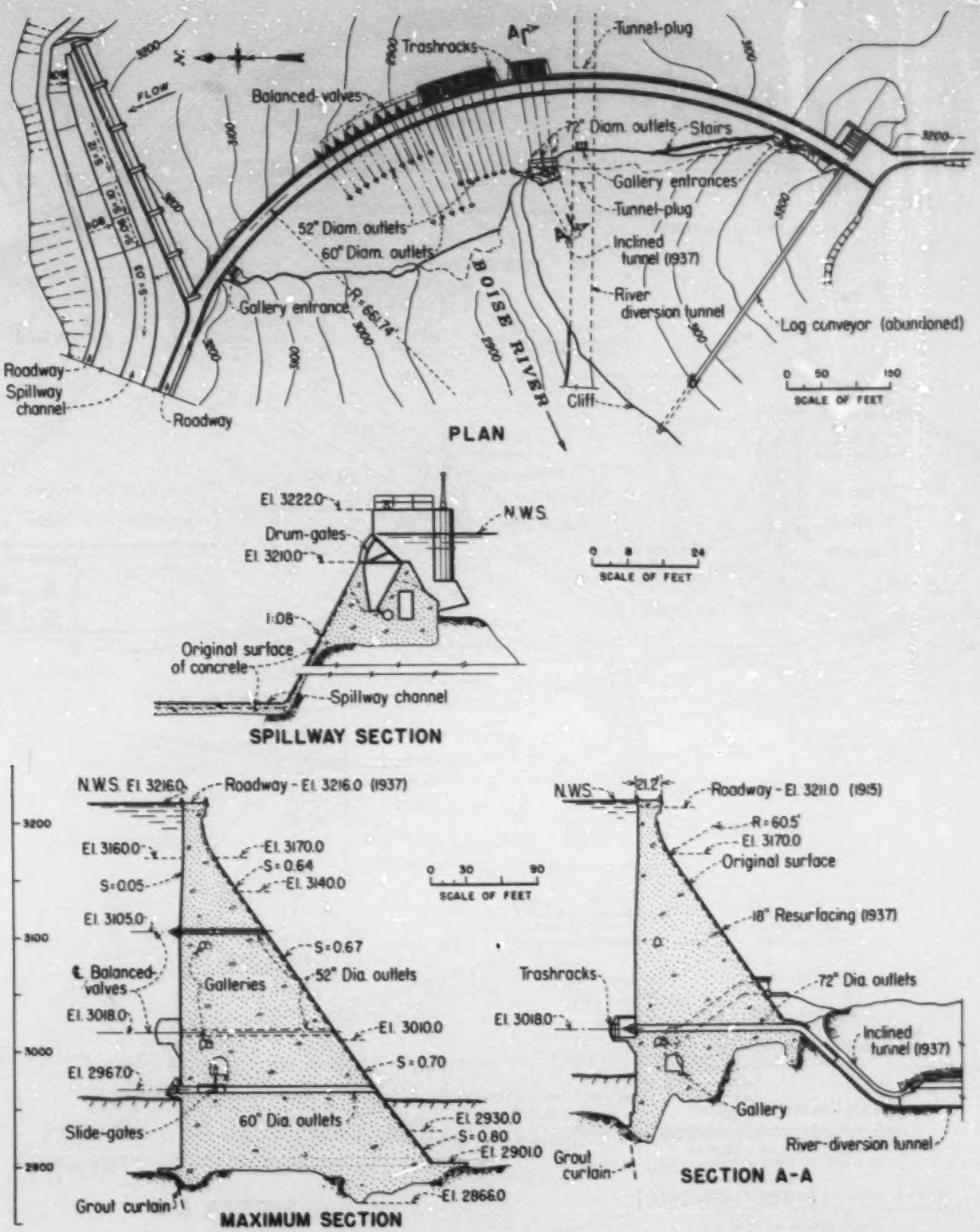


SECTION IN RIVER CHANNEL

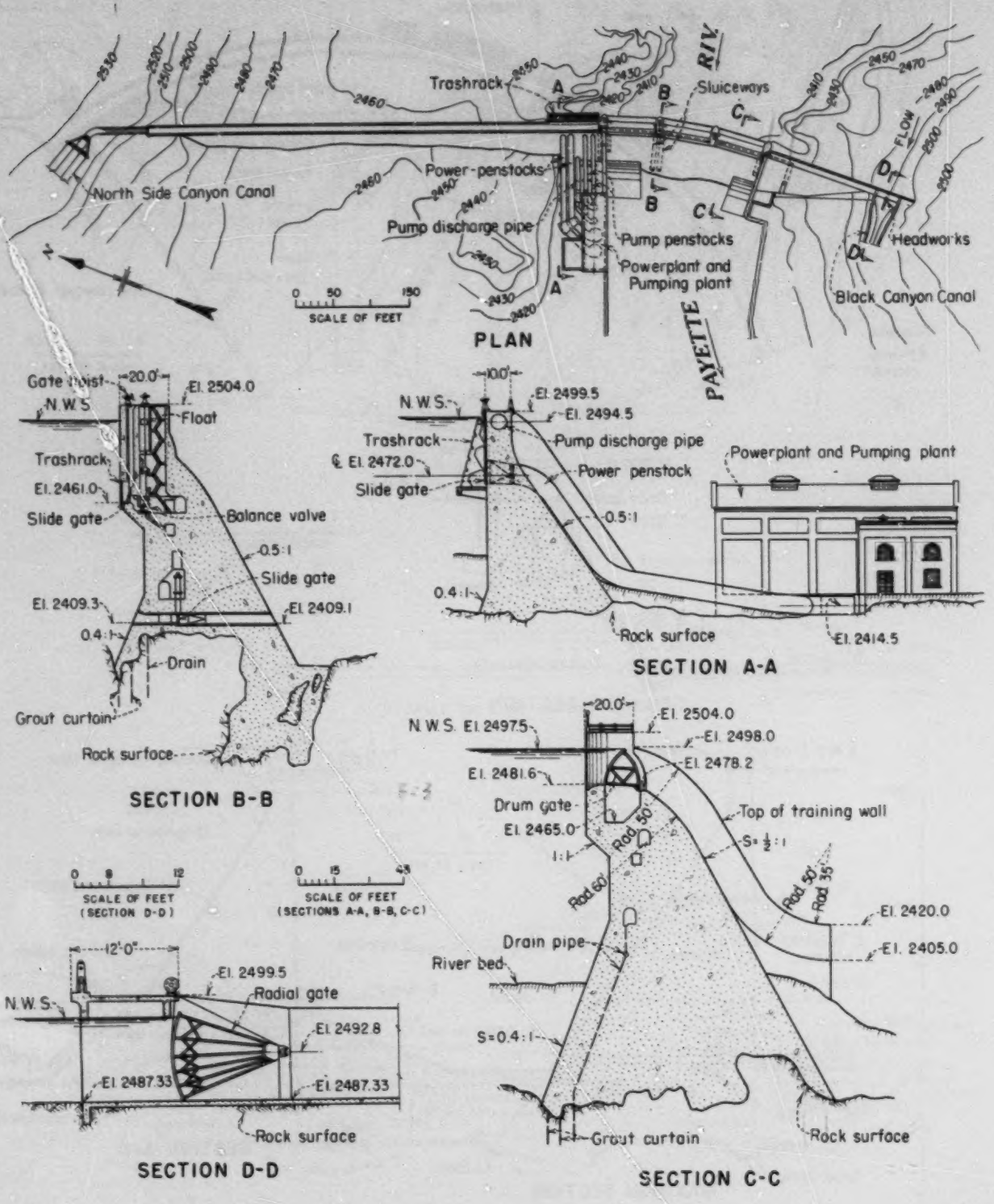


SECTION A-A

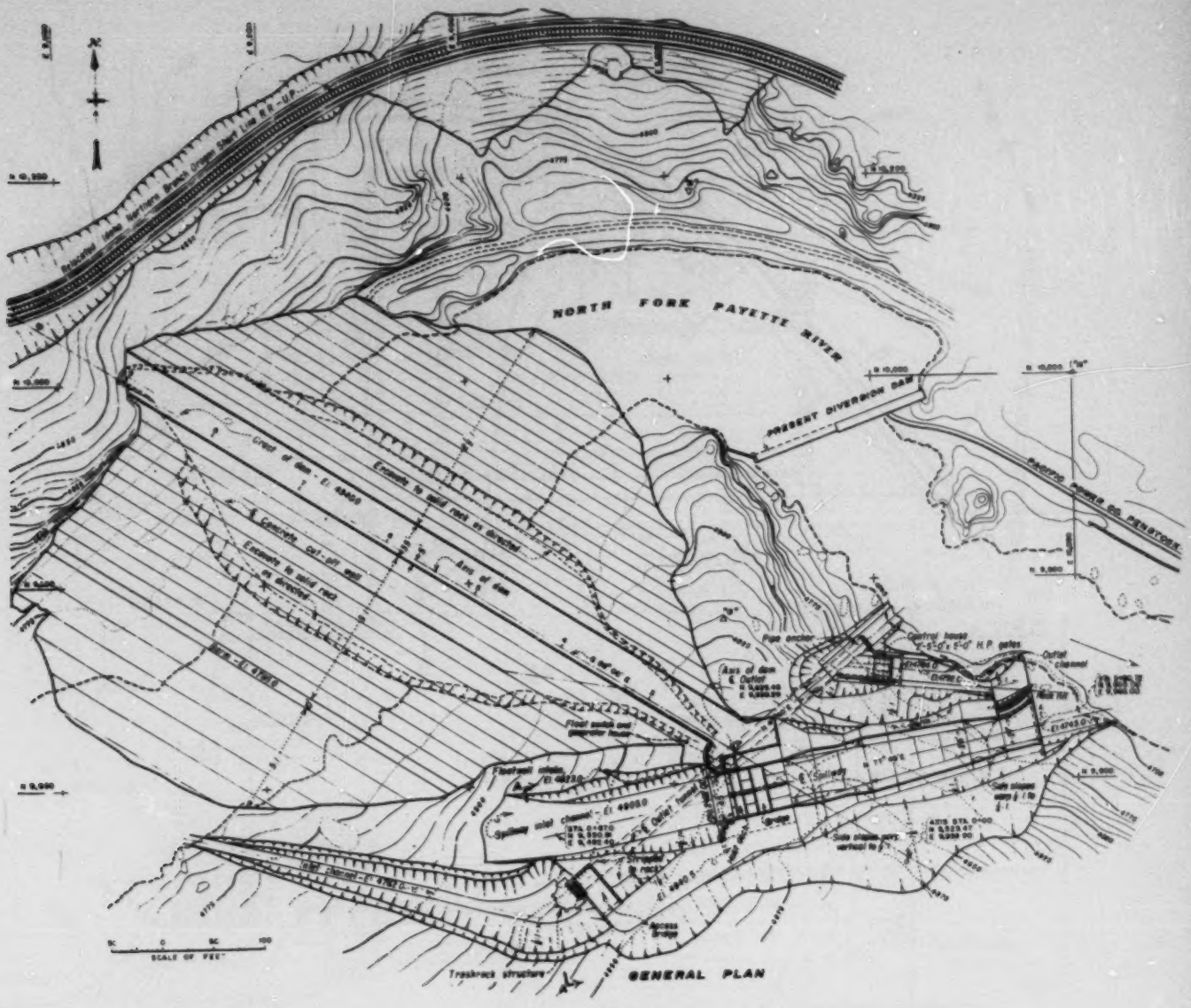
Anderson Ranch Dam, Plan and Sections

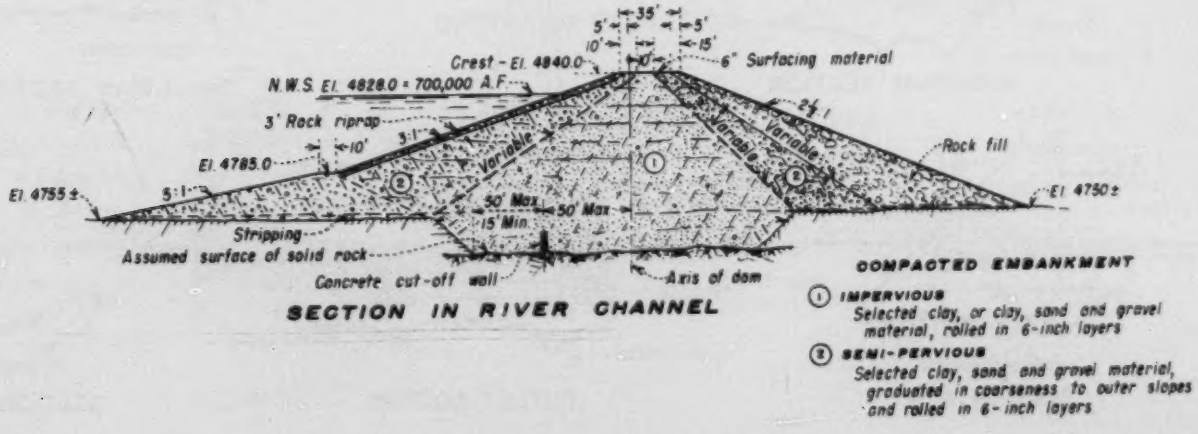


Arrowrock Dam, Plan and Sections



Black Canyon Dam, Plan and Sections



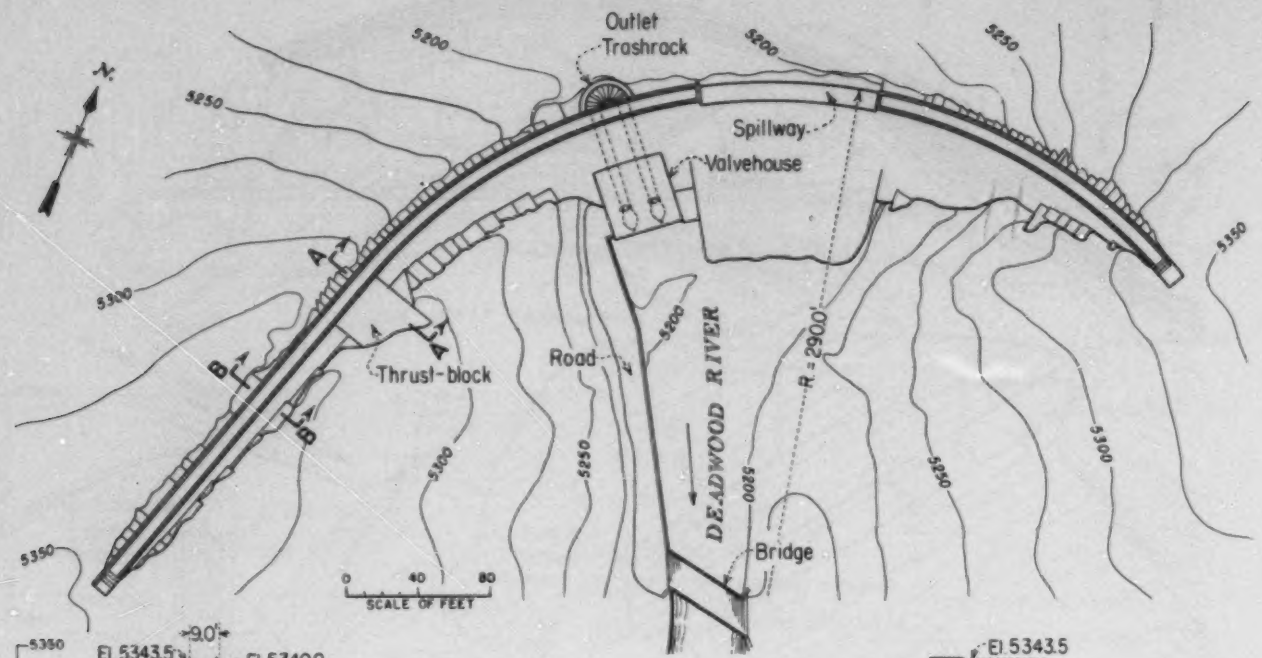


COMPACTED EMBANKMENT

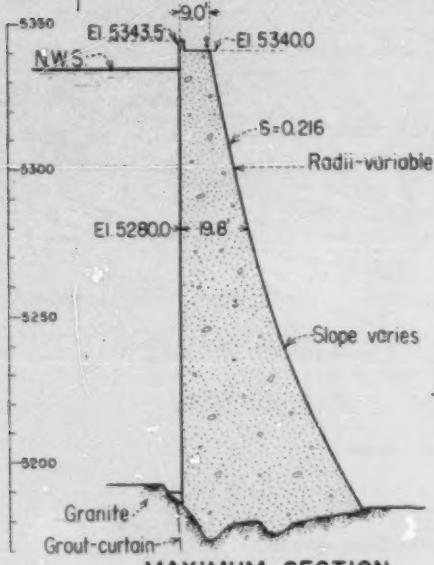
(1) **IMPERVIOUS**
Selected clay, or clay, sand and gravel material, rolled in 6-inch layers

(2) **SEMI-PERVIOUS**
Selected clay, sand and gravel material, graduated in coarseness to outer slopes and rolled in 6-inch layers

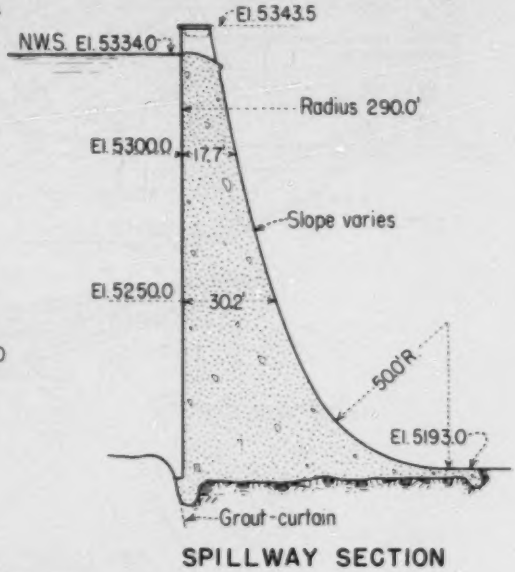
Cascade Dam, Plan and Section



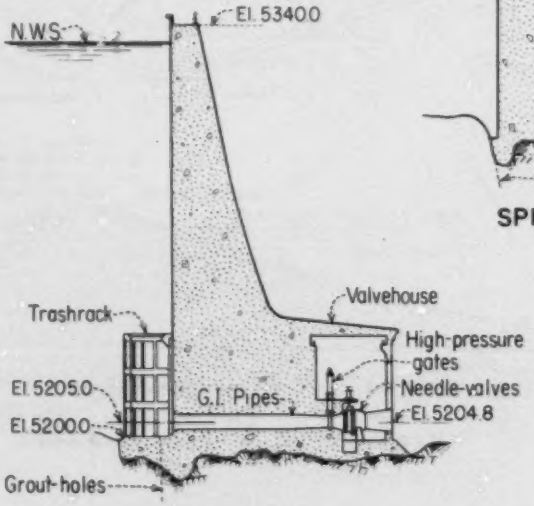
PLAN



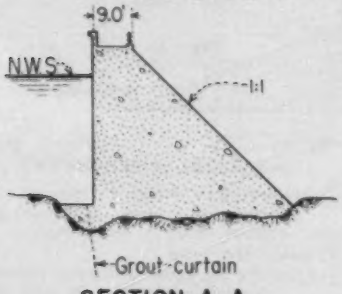
MAXIMUM SECTION



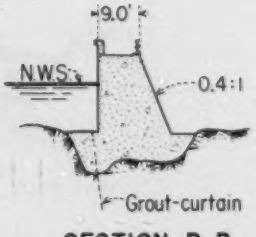
SPILLWAY SECTION



OUTLET SECTION

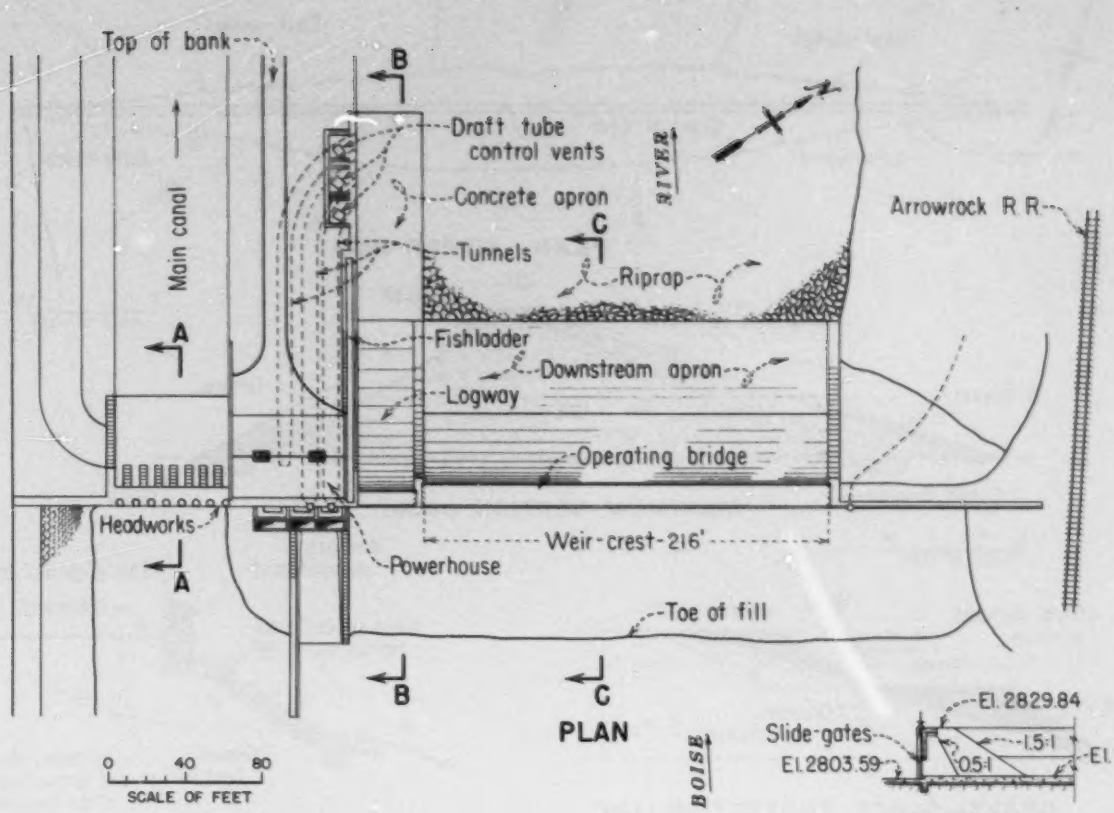


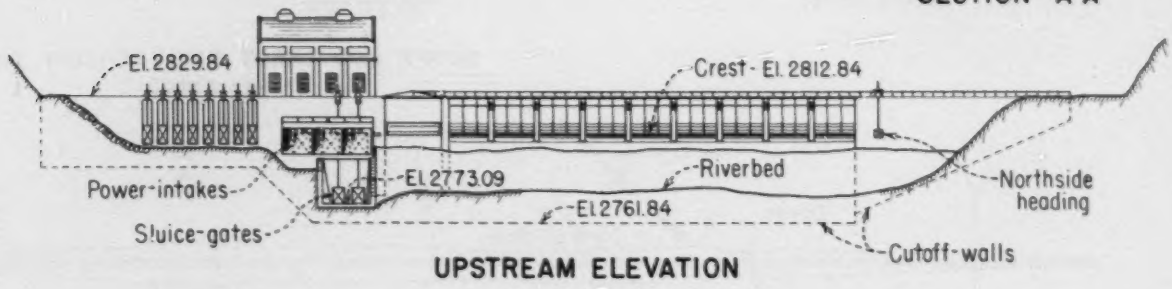
SECTION A-A

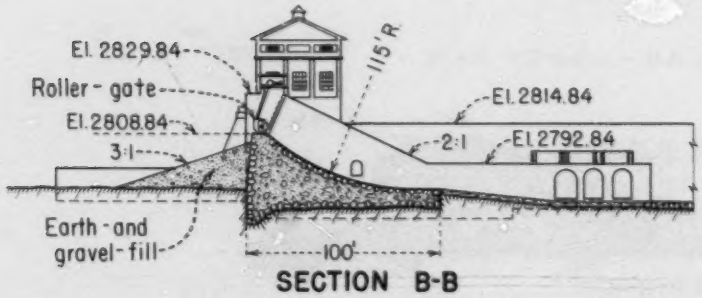


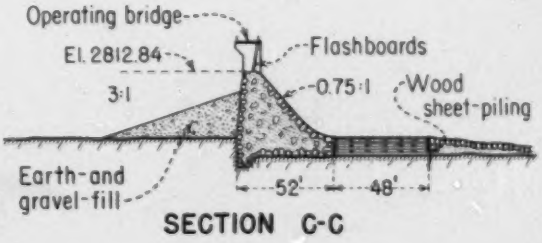
SECTION B-B

Deadwood Dam, Plan and Sections

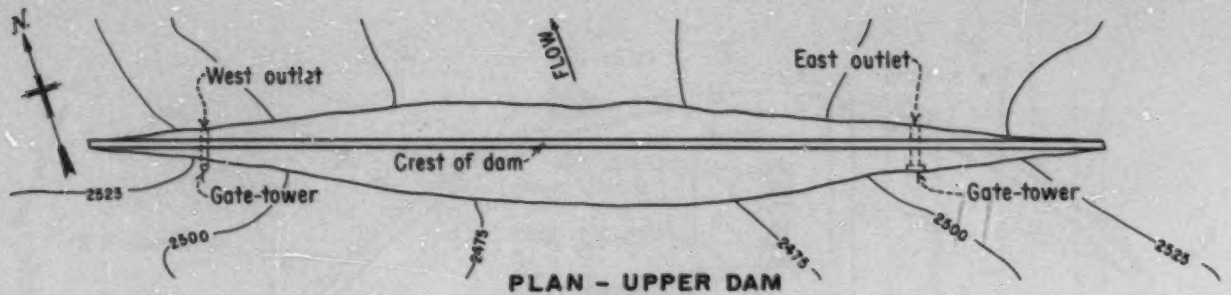




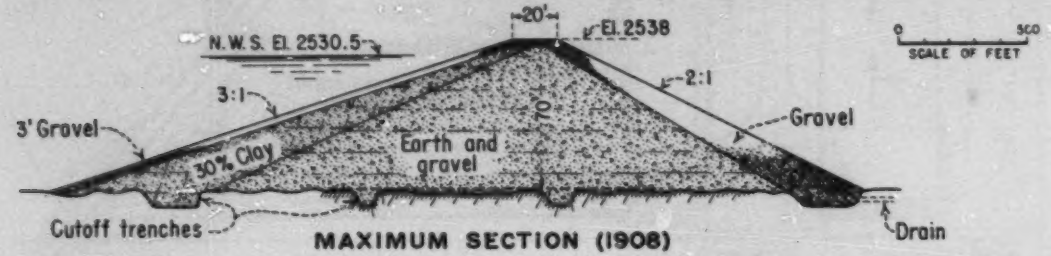




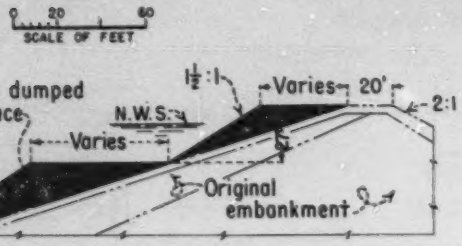
Boise River Diversion Dam, Plan and Sections



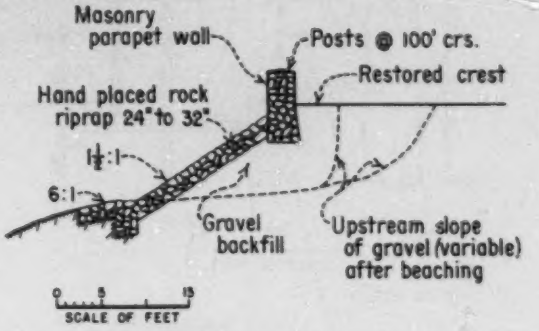
PLAN - UPPER DAM



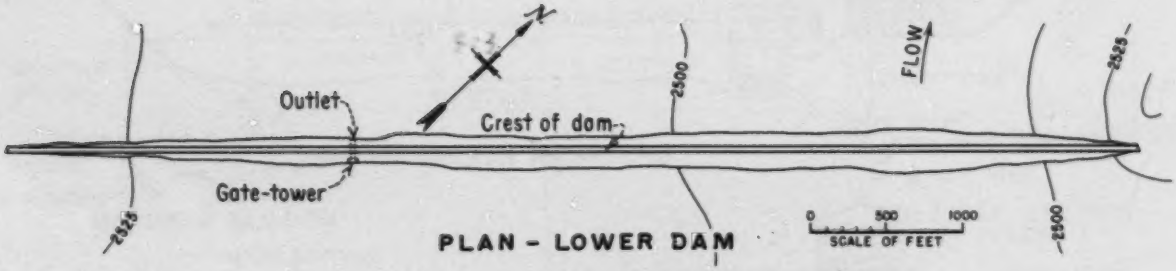
MAXIMUM SECTION (1908)



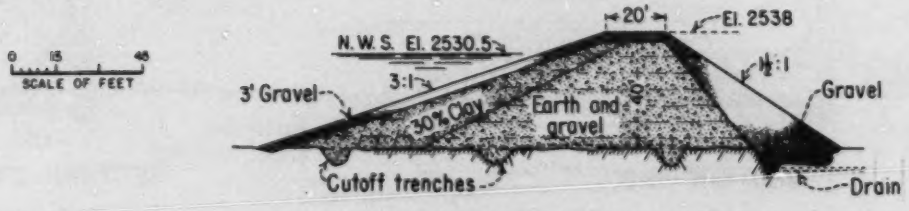
GRAVEL SLOPE PROTECTION (1911)
(Both dams)



SLOPE AND CREST PROTECTION (1938)
(Both dams)



PLAN - LOWER DAM



MAXIMUM SECTION (1908)

Deer Flat Upper and Lower Dams, Plans and Sections

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